Geophysical Research Abstracts, Vol. 8, 07756, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07756

An ultra-sensitive near-infrared spectrometer for in-situ water isotope measurement in the upper troposphere and lower stratosphere

Rosario Iannone (1), Daniele Romanini (2), Marc Chenevier (2), Samir Kassi (2), Hans-Jurg Jost (3), Suresh Dahniyala (4), Patrick Eddy (4), and Erik Kerstel (1)

(1) University of Groningen, Center for Isotope Research, Groningen, The Netherlands, (2) University of Grenoble, Laboratoire Spectrometrie Physique, Grenoble, France, (3) NASA Ames, Atmospheric Chemistry Branch, Moffet Field, CA, USA, (4) Clarkson University, Potsdam, NY, USA

(e.r.t.kerstel@rug.nl Phone: +31-50-3634759)

Water is the most important greenhouse gas. Detailed understanding of the water cycle and transport into the stratosphere is therefore important for prediction of future climate change. Both radiative forcing and chemistry are affected by water in the stratosphere. Stratospheric water has an effect on both the production of OH radicals and the formation of polar stratospheric clouds, which modulate polar ozone destruction. Remote sensing and *in-situ* measurements indicate a trend of increasing water concentrations in the stratosphere in recent decades. However, recently it has been noted that this trend has reversed in satellite data. Understanding the process of dehydration of air entering the stratosphere through the tropical tropopauze and the origin and microphysical properties of radiatively important thin cirrus clouds in the tropical tropopauze layer, are among the key problems in Atmospheric Science.

Measurements of the isotopic composition of water vapor in the upper troposphere and lower stratosphere are vital in testing the various hypotheses of stratospheric aridity, the relative importance of large scale and convective transport processes, and the role of cirrus anvil clouds.

In order to address these issues, we have developed an ultra-sensitive near-infrared spectrometer *(Iris)* to measure *in-situ* the water deuterium and oxygen (^{17}O and ^{18}O) isotope ratios in the upper troposphere and lower stratosphere with a high tempo-

ral resolution (between 0.1 and 10 seconds, corresponding to a spatial resolution of roughly 20 meters to 2 km). The spectrometer is based on ultra-sensitive optical-feedback cavity enhanced absorption spectroscopy. The instrument is lightweight (45 kg) and small ($<$ 50 liter). Together with a low power consumption and the absence of cryogens, this makes it uniquely suited for operation on Unmanned Aerial Vehicles and high altitude aircraft. It was first flown on the NASA DC-8 in 2004, demonstrating a superior level of precision, and recently tested on the stratospheric WB-57F.